1. Answer followings.

(1) Human eye has angular resolution of 30cpd. Find the pixel pitch when individual pixels are not identified at 30cm observation distance. Answer in um unit. [3]

Pixel Pitch (in micrometers, μm) =Angular Resolution)) * (Observation Distance)

First, let's convert the angular resolution from degrees to radians, as trigonometric functions in the formula typically use radians:

Angular Resolution (in radians) = * (30 cpd) * (1 degree / 360 degrees) * (2π radians / 1 cycle)

Angular Resolution (in radians) =(30/360) * (2π)

Angular Resolution (in radians) = π/6 radians=0.5236 radian

Now, you can calculate the pixel pitch:

Pixel Pitch (in μm) =30 cm*0.5236 radian

You'll need to convert the observation distance from centimeters to micrometers because the result should be in micrometers:

1 cm = 10,000 μm

So, Observation Distance (in μm) = 30 cm * 10,000 μm/cm = 300,000 μm

Now, calculate the pixel pitch:

Pixel Pitch (in μm) = 300,000 μm* 0.5236 radian

Pixel Pitch ≈ 157080 μm

So, the pixel pitch when individual pixels are not identified at a 30 cm observation distance is approximately 157080 μm

(2) Answer to the problem 1-(1) using ppi unit. (1 inch = 25.4mm) [2]

To answer problem 1-(1) using the ppi (pixels per inch) unit, you need to convert the pixel pitch from micrometers (um) to pixels per inch.

1 inch = 25.4mm => Pixels per Inch (ppi) = 25.4 mm / Pixel Pitch (cm)

Pixel Pitch ≈ 157080 μm=15.7080 cm

Now, you can calculate the ppi value:

ppi ≈ 2.54 cm / 15.7080 cm

ppi ≈ 0.1617 ppi

So, when expressed in ppi (pixels per inch), the pixel pitch is approximately 0.1617 ppi

.

2. What are the self-emissive displays among the followings. Select all that apply. [4] CRT, PDP, LCD, OLED, LCOS, OLEDOS, FED, DMD, EWD, EPD, micro-LED

Self-emissive displays are display technologies in which each pixel emits its own light, and these display technologies are: CRT,PDF,OLED,FED

1. CRT (Cathode Ray Tube): CRT monitors are self-emitting displays in which each pixel produces its own light because beams of electrons produce light directly by exciting phosphors.

2. PDP (Plasma Display Panel): Plasma screens are also self-emissive screens because the gas contained in the small cells produces ultraviolet light when electrically charged, which enables the phosphors to produce visible light

3. OLED (Organic Light Emitting Diode): OLED displays are self-emissive displays. Each pixel of an OLED display consists of organic materials that emit light when an electric current is applied.

4. FED (Field Emission Screen): FED screens are self-emitting screens. Electron emitters use a CRT-like method to produce light.

5.Micro LED: Micro LED technology is a self-emissive display technology in which each pixel has its own miniature LED light source.

6.OLEDOS-It is self-emissive, which means that unlike LCD displays, they do not require a backlight unit. Because it emits its own visible light.

So, self-emissive displays among the options you provide are CRT, PDP, OLED, and FED. Others are not self-leveling screens.

4. A LCD has 3840(H)x2160(V) resolution, 120Hz frame rate, and 8bit depth. Answer followings. (Assume that each pixel consists of RGB subpixels) (□ [2]□)

(1) 1F time, (2) 1H time, (3) The number of Data lines, (4) The number of Gate lines, (5) The number of Pixel electrodes, (6) The number of TFTs, (7) The number of color filters, (8) The number of expressible colors, (9) The number of Source driver IC’s output levels, (10) The number of Gate driver IC’s output levels

(1) 1 Frame (1F) Time:

- The frame rate is 120Hz, which means there are 120 frames per second.
- To find the time for 1 frame, you can calculate the reciprocal of the frame rate.
- 1F Time = 1 / 120 seconds

2)1H time: This is the time taken to refresh one horizontal line (or row). It can be calculated by dividing the 1F time by the number of vertical lines:

1H time=1F time /Number of vertical lines== (1 / 120 seconds) / 2160 lines

(3) The Number of Data Lines:

- The number of data lines is equal to the horizontal resolution.
- Number of Data Lines = 3840 *3

(4) The Number of Gate Lines:

- The number of gate lines is equal to the vertical resolution.
- Number of Gate Lines = 2160

(5) The Number of Pixel Electrodes:

- Each pixel consists of RGB subpixels.
- Total number of pixel electrodes = Resolution (H) x Resolution (V)
- Number of Pixel Electrodes = 3840 x 2160 *3

(6) The Number of TFTs (Thin-Film Transistors):

- Each pixel has one TFT, so
- Number of TFTs = Resolution (H) x Resolution (V)) x 3 (for RGB)= 3840 x 2160 *3

(7) The Number of Color Filters:

- Each pixel has a color filter for RGB subpixels.
- Number of Color Filters = Resolution (H) x Resolution (V) x 3 (for RGB)
- Number of Color Filters = 3840 x 2160 x 3

(8) The Number of Expressible Colors:

- The depth is 8 bits per channel (for each RGB color).
- Number of Expressible Colors = 2^8 (for each R, G, B channel)
- Total number of expressible colors = (2^8)^3 (for RGB)
- Number of Expressible Colors = 16,777,216 colors iki ustu 24

(9)

- Number of Source Driver IC’s Output Levels = 256*2(inversion driving)=512

(10)

- Number of Gate Driver IC’s Outpsut Levels = 2 (high level(on),low level(off)) (hanski ki slaydda on=20 V idi off=5V idi)